
WHY ARE STUDENTS RUNNING AWAY FROM THE COMPUTING MAJOR? AN EXPLORATORY STUDY

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ABSTRACT

The current reality of IT skills shortages in general and the lack of students in computing in particular has been a subject of interest in the United States in the last decade. We need to better understand the educational environment, especially at the middle school and the high school level, in order to generate interest about technology related preferences, habits, and interests. The purpose of this paper is to study the perceptions of incoming college students regarding the information technology/computing major. This study used a cross-sectional survey methodology for data collection. Findings included confusion about the definition of information technology, negative connotations of the IT field, and lack of awareness among college students concerning technology. Proactive strategies are required to encourage the participation of students in computing related courses and careers.

Keywords: IS curriculum, enrollment, recruitment strategies, IS perceptions, cross sectional survey

INTRODUCTION

Information Systems (IS) and other computing related fields have witnessed declining student enrollments [23]. Enrollments have been on decline in IS programs for a while even though the industry employment outlook remains good. IT careers are expected to be the fastest growing and highest paying careers in the next decade [1]. IT workers are essential to every modern business model [22]. Employment of computer systems analysts is expected to grow 22 percent from 2010 to 2020, faster than the average of all occupations [4]. Growth in wireless and mobile networks will create a need for new systems. Technology jobs are predicted to grow at a faster rate than all other jobs in the professional sector, up to 22 percent over the next decade, according to the Bureau of Labor Statistics. Labor trends show that 1.4 million computer-related jobs will be added in the U.S. by 2018, according to the U.S. Department of Labor and the Bureau of Labor Statistics, 2012. The top ten leading fields in the IT field are IT consultant, cloud architect, computer forensic investigator, health IT specialist, mobile application developer, web developer, software engineer, information technology vendor manager, geospatial professionals, and data modeler. Information technology workers are highly specialized in their field. They like what they do and understand it [20].

Information system, as a discipline, is still in a state of establishing its unique identity in minds of young prospective students. There is confusion over the definition of the field about how or why is it different from information technology or computer science. Information systems, in this research, is the resultant system arising from interaction of technological tools and people using these tools through policies and procedures of an organization. According to this perception of information systems, information technology is a subset information system that covers the hardware, software and networking solutions. Thus IS and IT are not interchangeable terms. It is important to establish this distinction, especially in terms of available career choices for majors in information system field.

A better understanding of perception of today's college students about computing would help in restructuring pedagogy and curricula in order to attract more students in the IT field. We need to better understand the educational environment, especially at the middle school and the high school level, in order to generate student interest about technology related preferences, habits and interests [23]. The purpose of this paper is to study the perceptions of incoming college students regarding the Information Technology/Computing major. The research questions that this study addresses are:

RQ1: What are the perceptions of incoming college students about the information technology/computing field?

RQ2: What can we do to encourage enrollment in college information technology/computing programs?

The next section presents an analysis of existing research literature in the area of information technology/computing. The section following the literature review presents the methodology used for this study including data collection and data analysis. The discussions from the findings from the data will be presented in section four followed by the conclusions for this study.

LITERATURE REVIEW

The enrollment issue in IS has been discussed and researched for several years now. This is a critical problem and the consequences of ignoring the low enrollment problem are severe indeed. IS programs have been eliminated or disbanded, and tenured faculty have been laid off [8]. The severity of this crisis can be gauged by the fact that Florida State University eliminated its highly-regarded IS department and merged it into Management; whereas, the University of Central Florida eliminated IS programs (Bachelor's, Master's, and Doctoral), shutting down the department and terminating the contracts of all faculty, including tenured full professors [12].

McInerney and DiDonato (2008) conducted focus group interviews of information technology students and found that the major influences in choosing a computing major were positive experiences in high school, an aptitude for math, perceived job prestige, encouragement of family members, and key teacher input. Students did not have the negative stereotypes and attitudes toward the field. Research in this area consistently suggests that lack of K-12 computing courses at middle and high school level, lack of accurate career information about computing related careers, and absence of mentors in the field all play a role in inadvertently turning young students away from the industry [1].

There have been several studies in this area to understand the underlying social and cultural dynamics behind this IT situation. Leidner and Kayworth (2006) presented a review of 82 research studies of the organizational and cross-cultural IT literature that links culture with IT. The authors proposed that culture in general is a critical variable in explaining how social groups interact with IT and that there is a gap in the literature in defining the values, attitudes, and enculturation in IT.

Administrators at universities have been working on solutions to this delicate problem of declining enrollment in IT. In order to address this problem, it is important to understand the factors that facilitate and impede the attraction, recruitment, and retention of IS majors. It is important, in this context, to understand the underlying perceptions of incoming freshmen a student (both IT majors and non-IT majors) about what the information system discipline is all about. Good IT students need basic analytical skills and concentrated interests in science, technology and math, and computer technology encompassing the K-12 level is a necessary component [3]. Increasing IS enrollment requires partnering with a variety of external stakeholders to make them aware of the IS enrollment problem and to ask for their help addressing the problem [12]. These stakeholders could include other disciplines in the school, current majors who are in the program, career services, and potential employers.

It is also important to develop program-building initiatives to develop a strong bond between the program and the students. An important step towards this relationship building would be empowering current students with the responsibilities of educating and attracting non IT majors to IT programs. IT majors can provide key insights into designing events that appeal to freshman students. Opportunity, empowerment, and recognition are three of the best incentives that help in motivating student commitment [12].

RESEARCH METHODOLOGY

Methodology

This study used a cross-sectional survey to collect data by asking all of the students in four sections of INFS1020 Introduction to Decision Support Systems at a private four-year university in southwestern PA about their perceptions of the IT/computing field. The goal of descriptive surveys is to get a snapshot or to describe the respondents by gathering demographic information, personal information, and attitudinal information. Exploratory research is conducted to provide a better understanding of a situation.

The cross-sectional design is effective for providing a snapshot of the current behaviors, attitudes, and beliefs in a population. A cross-sectional survey is one in which data are collected from selected individuals at a single point in time [7].

Data Collection

All of the college students in four sections of INFS1020 Introduction to Decision Support Systems were surveyed, totaling 94 students. There were 60 males and 34 females. Of the group surveyed, 57 were freshmen; 24 were sophomores; 10 were juniors; and 3 were seniors.

The goal of this research study was to find out from incoming college students their perception about information technology/computing. The study had two main research questions. In order to gather student perceptions, additional questions were asked to generate the student's perceptions about the topic. The questions were as follows:

- (1) How did you select your current major?
- (2) Have you ever considered a career in the information technology field? Why or why not?
- (3) In what ways did various people provide personal advice/information about your career choice?
- (4) How would you define information technology/computing?
- (5) What jobs come to mind when you think of information technology/computing?
- (6) What specific technology skills are required by your chosen major?

See Appendix A for the survey instrument.

Data Analysis

Several majors were reported by the group. Table 1 shows the number of students enrolled in each of identified majors.

Table 1: Majors Identified

Engineering (18)	Psychology (5)
Business (14)	Cyber Forensics (3)
Accounting (8)	Graphics/Media Arts (3)
Actuarial Science (8)	Sport Management (3)
Biology (7)	Education (2)
Communications (7)	Hospitality & Tourism (2)
Finance (6)	Marketing (2)
CIS (5)	Economics (1)

In response to Question 1 about how students selected their major, parental advice/family had the most impact on their decisions, with employment opportunities following close behind. A high school teacher played a significant role in 11 respondents' decisions.

Table 2: Selection of Major

Parental advice/family (37)
Employment opportunities (35)
High school teacher (11)
Personal interest for many years (9)
Guidance counselor (5)
Friends (4)

In response to Question 2 about whether the student ever considered a career in the information technology field, 65 responded no and 29 responded yes. The open-ended question allowed the researchers to find out why the students did or did not select IT as a major. The reasons why or why not the student considered the IT field are as follows:

Table 3: Why Did You Consider the IT Field?

Enjoy working with computers and technology (12)
Information technology field is a growing career (12)
Money (1)
Requires math, which is best subject (1)

Table 4: Why Did You Not Consider the IT Field?

Does not personally interest me (25)
Not interested in learning computer programs (6)
Haven't heard much about it; don't know what it is (6)
Not good with computers (5)
Don't want a cubicle job (5)

In response to Question 3 concerning in what ways did various people provide personal advice/information about career choice, the responses were generally positive with 37 responding Somewhat Helpful and 9 Very Helpful about providing personal encouragement about selecting courses towards the student's career choice. In response to providing personal advice/information about your career choice, the responses were generally split between Somewhat Helpful and Very Little. The same responses were found when students were asked about providing information about the employment outlook for your career choice. The majority responded Somewhat Helpful and then the responses were Not At All and Very Little.

In response to Question 4 about defining information technology/computing, the responses were short because it was an open-ended question.

Table 5: Definition of Information Technology/Computing

Dealing with any type of computer or technology (16)
Using the latest technology and computers to create new things to make life easier (12)
Dealing with technology in today's society and using it to do daily things (8)
An area of work that deals with computers and technology to process information and make it useful (6)
Coding software to collect data (5)

Some of the other responses given by students were computer programs, the backbone of modern industry, knowing how to work and fix computers, and using computers to solve problems.

In response to Question 5 asking what jobs come to the student's mind when he/she thinks of IT/Computing, the standard positions were identified—programmer, technical support, etc.

Table 6: What Jobs Come to Mind When You Think of Information Technology/Computing?

Programmer (49)
Technical support (45)
Software engineer (29)
Web developer/designer (26)
Systems analyst (25)
Database manager (19)

Twenty-three students selected all of the choices instead of just one.

In response to Question 6, what specific technology skills are required by the student's chosen major, the majority of the students said basic computer skills. However, basic computer skills were not explained in detail.

Table 7: What Specific IT Skills are Required by Your Current Major?

Basic computer skills (18)
Excel (spreadsheets) (17)
Microsoft Office (14)
Don't know (6)

Some other skills mentioned by only one student were learning a software language, using technology to figure out calculations and make predictions, using cell phones to network and do functions, and AutoCad.

DISCUSSION AND RECOMMENDATIONS

This study presents the survey results about the perceptions of incoming college students about the information technology/computing major. The methodology of conducting this study, along with the results, is presented. Recommendations are provided to identify ways for educators and family members to encourage students interested in the IT field and to encourage enrollment in the college information technology/computing programs. Confusion about the definition of information technology/computing, the negative connotation of the IT field, and lack of awareness concerning technology are three areas of concern that will be discussed below.

Confusion about the Definition of Information Systems/Information Technology

In reviewing the survey results, there was confusion about the definition of information technology. There is a broad disagreement about the definition of information systems. This varying conception of information technology surfaced in the survey and the researchers believe that this has deeper consequences than it appears to have. The field of information systems is increasingly enduring a credibility crisis [18]; i.e., what are information systems or how is it different from information technology? The confusion regarding the IS discipline is evident in the variety of schools and colleges that house IS programs: colleges of computing, information, library science, and computer science, as well as business schools [18]. This confusion of identity manifests itself in declining enrollments, under appreciation of value of IS, and questions about the relevance of IS [6].

Computer information systems can be viewed as the process of development, installation, and implementation of computer systems and applications. The survey group primarily viewed it as dealing with any type of computer or technology. The bigger picture of computing was missing—the whole idea that computing is the ability to access, evaluate, use, and manage information, regardless of career choice. This myopic perception of the technology field inadvertently limits the scope of education and career options of the students. There is a plethora of career opportunities in the technology field, which could be appealing to students, provided they understand and explore these possibilities.

IS needs a repositioning in the minds of students enrolling in universities. It is important to establish that a sound knowledge base about IS would help in multiple professions and disciplines. Having a basic understanding of information systems will make students of all disciplines a better “consumer of technology” in their chosen field of major or profession. This “value added” perspective of IS can work with employers or other departments to design courses suiting different majors. The need of the hour is to create IS courses that serve the needs of IS majors as well as add value to other programs.

Negative Connotation of the IS Field

The data suggests that students have a limited and rather technical perception about the information systems major and career. The issue may have to do with cultural norms and the stereotype of who works in IT. This finding is consistent with what other researchers in this domain are suggesting about negative perception of the field ([9], [15]) deter students from taking up the major. The general image of IS majors is that of nerds sitting in front of computers all day. Work of IS professionals is perceived to involve extensive programming requiring long hours combined

with constant pressure of keeping up with new technology and upgrading skills [11]. High school and business school students have reported that they consider IT related careers as highly technical in nature that require an aptitude that they do not possess [15]. Negative stereotypes of the IT profession abound: being geeky, nerdy, and that the IT jobs require sitting in front of the computer all day [17]. This leads the students to believe that coursework in IT is hard and does not match their personality types and capabilities.

Some of the typical stereotypes about a person working in IT are “nerd”, “geek”, and “introvert”. Some of the misconceptions include IT people don’t understand business and IT people lack social skills. In order to eliminate the negative connotations, one must first become aware of them. Overcoming the stereotype of the “tech geek” may take some time. Success in the industry is framed as being dependent on expertise [21] and the best way to address the problem is by addressing this culture and reestablishing what computing is. Stereotype threats influence choices and aspirations.

The researchers recommend that it is important to proactively take on these myths or false perceptions head-on. More awareness about this topic would lead to a changed perception of the IT field. It is a core functionality of an organization and requires communication and managerial skills to succeed just like any other functionality in the organization. Research suggests that students when exposed to IS are able to recognize the changing nature of IS and that it requires managerial, communication, and problem solving skills in addition to technical knowledge [11]. Advertising and promotion activities, along with the knowledge and awareness of the academic advisors about the IS profession, have the potential of educating students in a shorter period of time [9].

It is beneficial for colleges and universities to develop early intervention strategies for students at the high school level and get them excited about IT prospects. The IS department at this 4-year university has been proactive in interacting with high schools. We hosted a half day “Information Technology/Computing Event” where high school teachers and guidance counselors were invited. Different aspects of IS education was highlighted.

Lack of Awareness Concerning Technology Use in Their Chosen Major

Almost all jobs now require some basic understanding of computer hardware and software, especially word processing, spreadsheets, and email [10]. The top ten “valued” workplace skills include communication, organizational, computer, interpersonal, analytical, leadership, problem solving, time management, mathematical, and professional skills [19]. Technology literacy is a requirement of all work environments. Technology literacy means being able to evaluate new technologies and how to use the new tools. It stresses applying technology effectively. Using technology to gather, analyze, and synthesize information is a basic requirement of any organization.

This trend towards a negative effort/risk and reward perception of technology related fields may be emblematic of the general decline in enrollment in all Science, Technology, Engineering and Mathematics (STEM) related fields [17]. Thus, declining enrollments have to a large extent been attributed to this gap between perception and market conditions. Joshi et al. (2010) suggested that the students do not perceive that business and organizational skills such as leadership, customer and relationship skills are critical to succeed in IT careers. The students felt that a strong technical understanding is required to get into an IS field. This suggests an opportunity for developing interventions and strategies that can help to attract students who have good non-technical skills.

Literacy skills help students gain knowledge through reading as well as using media and technology. Information literacy involves traditional skills, such as reading, researching, and writing, but now there are new ways to read and write. The new skills are consuming information and producing information. Consuming information means taking information, checking it for bias and errors, and making sense of the information. Producing information means understanding what is written, being professional, and learning to be effective and ethical producers of information [20].

According to the Center for 21st Century Skills at Education Connection (2013), six critical skills that form the foundation for 21st century success are information literacy, creativity and innovation, collaboration, problem solving, communication, and responsible citizenship. Information literacy is using appropriate applied research to any problem and the ability to find useful and reliable information. Responsible citizenship means demonstrating the proper use of technology, global awareness, and moral capacity. Two of the six critical skills relate to IT.

Awareness about information systems opportunities, its role in today’s business operations, and most importantly the job prospects in IT field is the first step towards dealing with this “Why do I need to learn this?” about IT. These awareness campaigns need to address common myths about IT and the most important message in the awareness campaigns is the positive job outlook for IT graduates [13].

Based on our survey results, we propose the following recommendations be made (Table 8).

Table 8: Recommendations

Research Questions	Findings	Recommendations
What are the perceptions of incoming students about the information technology/computing field?	<ol style="list-style-type: none"> 1. Much confusion about what IT/computing is 2. Negative connotation about the IT field 3. General lack of awareness about technology use in their chosen majors 	<ol style="list-style-type: none"> 1. Teachers or guidance counselors must provide personal encouragement to students interested in technology careers. 2. The students must be made aware of what IT is and what you do in the field through providing information sessions, role models, guest lecturers, etc. for the middle and secondary classrooms. 3. Change the stereotype of sitting in a cubicle isolated from the rest of the employees.
What can we do to encourage enrollment in college information technology/computing programs?	<ol style="list-style-type: none"> 1. Develop a consistent message about IT (definition and opportunities) 2. Develop a positive awareness about the IT field 3. Stress the 21st century workforce skills/literacy necessary for success in all professions 	<ol style="list-style-type: none"> 1. Secondary schools and higher education need to work together to develop an IT career awareness that has a consistent message for potential students. 2. Parents/family need to be informed about what IT is and the employment outlook for this career choice. 3. Higher education can provide role models, job shadowing, and/or field experiences for young people.

Recommendations

The first research question dealt with the perceptions of incoming students about the information technology/computing field. After reviewing the findings, the researchers believe that teachers and/or guidance counselors must be more involved in encouraging students to enter the technology careers. Students must be made aware of what IT is and teachers can help with providing information sessions, role models, guest lecturers and other possibilities in educating middle and secondary classroom students. Also, the stereotype of the “nerd” sitting in a cubicle needs to be erased from the IT profession.

The second research question dealt with encouraging enrollment in college information technology/computing programs. Secondary and higher education professionals need to work together to develop more IT career awareness. Parents/family need to be better informed on the employment outlook of this career choice. Higher education professionals can be involved by providing role models, job shadowing, and other field experiences for young people

In summary, the confusion about what information technology/computing really is may have prevented incoming students from entering the IT field. Some of the misconceptions about the IT field may have kept young people from seeking a career in information technology/computing. Finally, the lack of awareness about technology use regardless of chosen career may have played a role in not selecting IT as a college student’s major. More collaboration among middle school, high school, and universities is required to address these concerns and myths about IT/computing at a fundamental level. Becker and Thompson (2009) suggested that the collaboration and open

discussion that bridges the gap among secondary, postsecondary and the high demand technical workplace to achieve a rigorous and relevant seamless education environment that is quality-based. The input from business and industry will provide the real world skills and knowledge necessary for meeting the global market and the professional standards that should be the foundation of IS curriculum.

This study contributes to the body of knowledge in several ways. First, the study enabled the researchers to recommend ways that educators and family members can encourage students who are interested in IT and help them make informed decisions about career choice. Second, this study identifies specific ways to encourage enrollment in college IT/computing programs. With technology jobs predicted to grow at a faster rate than all other jobs in the professional sector, IT educators have a responsibility to develop a positive awareness about the field. There are multiple avenues of research that arise from the current study. It would be interesting to survey high school students to understand their perception of IS/IT careers. Another area of research would be to investigate if there is any correlation between students' high school GPA and their propensity to choose a career in computing. A third area of research would be to investigate what colleges are doing to recruit high school students into the IS/IT field.

CONCLUSIONS

This study clearly suggests that changes need to be made in order for more young people to enter the IT/computing field. This paper is targeted at the perceptions of incoming college students about the IT/computing field. Information was gathered through a survey, which asked both closed- and open-ended questions to understand the students' perceptions. It is evident that teachers and/or guidance counselors, along with parents and/or family, need to help students make career choices. All of the strategies presented in this paper can work in attracting students in the short run; but to improve and sustain more enrollments in IS programs, a long-term commitment from administration at the universities is required. The students who choose to enroll need to get a satisfying experience in order to stay with the program.

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Appendix A

INFS1020
Fall 2013

Gender: Male _____ Female _____

Level of Education:

_____ Freshman

_____ Sophomore

_____ Junior

_____ Senior

1) What is your major? _____

2) How did you select that major?

_____ Parental advice/family

_____ Employment opportunities

_____ High school teacher

_____ Guidance counselor

_____ Friends

_____ Other (Please specify) _____

3) Have you ever considered a career in the Information Technology field? Why or why not?

4) In high school level, how much exposure to technology courses did you have?

_____ 0 courses

_____ 1 course

_____ 2 courses

_____ 3 or more courses

5) While in high school, in what ways did your teachers or guidance counselor provide personal encouragement about selecting courses towards your career choice?

_____ Not at all

_____ Very little

_____ Somewhat

_____ Very helpful

6) While in high school, in what ways did your teachers or guidance counselor provide personal advice/ information about your career choice?

_____ Not at all

_____ Very little

_____ Somewhat

_____ Very helpful

7) While in high school, in what ways did your teachers or guidance counselor provide information about the employment outlook for your career choice?

_____ Not at all

_____ Very little

_____ Somewhat

_____ Very helpful

8) In your own words, how would you define information technology/computing?

9) What jobs come to mind when you think of information technology/computing?

- Programmer
- Technical support
- Software engineer
- Database manager
- Systems analyst
- Web developer/designer
- Other (Please specify) _____

10) How important is it to you to have a basic understanding of technology?

- Not at all
- Very little importance
- Somewhat important
- Extremely important

11) How important is a basic technology course in your chosen major?

- Not at all
- Very little importance
- Somewhat important
- Extremely important

12) What specific technology skills are required by your chosen major?

13) How will this course help you to meet your career goals?
